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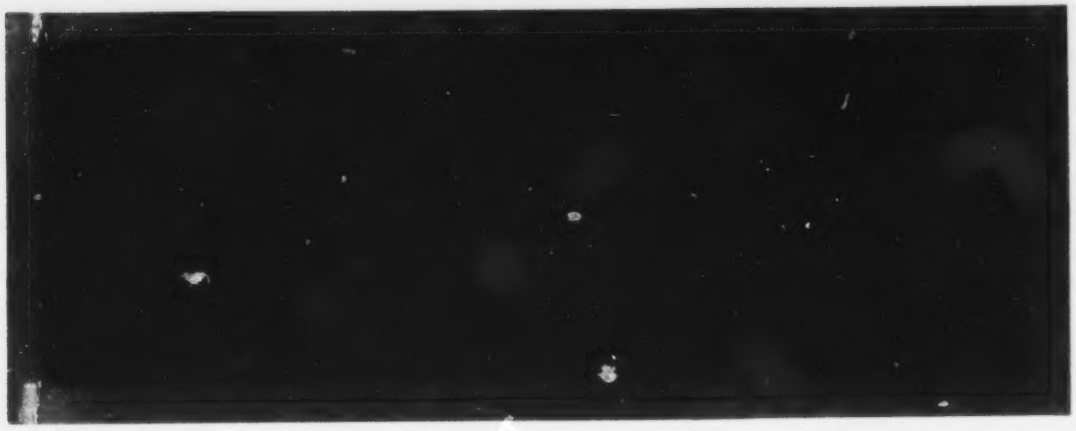

Methodology Branch

Census & Household Survey
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THE DEVELOPMENT OF MODEL-BASED ESTIMATES OF UNEMPLOYMENT FOR THE YUKON

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I. Background

Beginning in July 1981 the Labour Force Survey was extended to the Territory of the Yukon on an experimental basis. Subsequently, evaluation of the estimates obtained from the pilot survey revealed serious problems with both the survey's tracking of the Yukon population in the field and with the population projections used to weight the survey estimates. The adverse effect of these factors on the reliability of the survey estimates, and the inability in the short term to resolve the population estimation problem, made the permanent extension of the LFS to the Yukon distinctly problematical. The pilot was accordingly suspended in March 1983. Efforts since then have concentrated largely on developing model-based approaches to estimating unemployment for the Yukon. The aim of this report is to document some of those efforts and to summarize the results to date.

Although the Yukon Territory would generally be considered a small area for statistical estimation purposes, the model development work for the Yukon proceeded independently from similar efforts underway under Statistics Canada's Small Area Data Program.[1] It was hoped that attention could be focussed on the particularities of the Yukon economic situation, without the necessity of aiming for a model that would be of general applicability. In practice, however, for reasons which will be outlined further in this report, the advantages of focussing on the Yukon were somewhat limited.

II. The Use of Unemployment Insurance Beneficiaries for Estimation

In estimating unemployment in small areas, one of the most important sources of available information consists of the counts of Unemployment Insurance beneficiaries for the small area. Since efforts have been aimed at estimating unemployment according to Labour Force Survey concepts, the focus of attention has been the sub-group of

[1] The initial model development work for the Yukon was funded in part by the Yukon Territorial Government.

Unemployment Insurance beneficiaries that would generally be labelled as unemployed by the survey. Individuals in this sub-group are known as "regular beneficiaries without earnings" and are persons collecting UI benefits because they cannot find suitable employment, are available and able to work and have met the following requirements:

- had an interruption of earnings;
- had worked in insurable employment for at least 10 to 14 weeks in the last 52 weeks (in the Yukon this is always 10 weeks);
- had no work-related income (Regular beneficiaries are allowed to have work-related income up to 25% of the weekly benefit without reduction of benefit).

Conceptually regular beneficiaries without earnings correspond fairly closely to the job loser and job leaver component of the unemployed. The correspondence, however, is not exact. Beneficiaries may exhaust their benefit period yet still be considered unemployed by the Survey. Conversely, although job search and availability for work are requirements both to collect UI benefits and to be classified as unemployed by the Labour Force Survey, unless enforcement is strict, a person may stop looking for work (and thus leave the labour force according to the Labour Force Survey) yet continue to receive benefits. In addition a person may be a job loser or leaver without necessarily having fulfilled the 10 to 14 weeks of work per year required for UI eligibility. Despite the conceptual differences, on an annual average basis the two series agree well at the Canada level, as the following table illustrates:

TABLE 1. Job Losers/Leavers and Regular Beneficiaries Without Earnings, Canada, Annual Averages, 1981-1984

	Job losers and leavers	Regular beneficiaries without earnings
	thousands	
1981	620	572
1982	976	956
1983	1,059	1,030
1984	1,018	1,055

On a monthly basis, the UI counts tend to be higher than the job loser/leaver estimates from January to March and lower during September and October (See Chart 1 in the Appendix). Historically job losers and leavers have accounted for approximately 70% of total unemployment at the Canada level. In addition job losers have been shown to be instrumental in defining both the seasonality and the trend of unemployment in Canada.[2] The counts of regular beneficiaries without earnings thus constitute an invaluable auxiliary source of data for use in estimating unemployment in small areas.

III. Estimation Methods

Where a large area (eg. Economic Region) estimate of unemployment is available, an obvious strategy for estimating unemployment in small areas is to allocate the large area estimate to the various small areas within it by means of the beneficiary counts, i.e., each small area is assigned the same proportion of the large area estimate as it possesses of the total beneficiary counts for the large area. For this method (sometimes known as synthetic estimation) to yield unbiased estimates, the proportion of total unemployment in the small area accounted for by the beneficiary counts must be approximately the same as the corresponding proportion for the large area. The absence of any survey-based large area estimate for the Yukon, however, renders any direct use of synthetic estimation impossible.

Given the close correspondence between job losers and leavers, on the one hand, and regular beneficiaries, on the other, the problem of estimating unemployment in a small area reduces to estimating the proportion of the unemployed not accounted for by regular beneficiaries, namely, new entrants and re-entrants to the labour force. There is, however, no direct way of obtaining an estimate of this proportion for the Yukon. The problem is further complicated by the fact that the proportion is subject to seasonal variation, so that it must be estimated monthly or at least quarterly. Initially two alternatives were considered: 1) to estimate this proportion for Economic Regions

[2] See "Flows into Unemployment: The Job Loser Component", The Labour Force (Statistics Canada, Cat. No. 71-001), December 1984.

98-99 in northern British Columbia and 87-88 in northern Alberta and apply the result to the Yukon; 2) to estimate the proportion implicitly by regressing total unemployment on regular beneficiaries for the same Economic Regions, and to obtain estimates of unemployment for the Yukon by applying the resulting coefficients to beneficiary data for the Yukon. Both alternatives assume that the Yukon and northern Economic Regions are in some sense similar and that results derived for the latter will carry over to the former. The first alternative was rejected because of the sizeable sampling variability in the estimates of new entrants and re-entrants for northern regions. The regression approach was adopted because it guaranteed a certain stability in the resulting estimates. Initial results, however, were less than encouraging.

The assumption of homogeneity, that is, of similarity between the Yukon and Northern Economic Regions, at first appeared crucial to the success of a regression estimate. However, as the table of selected Economic Regions below indicates, Economic Regions themselves can hardly be considered homogeneous with respect to the proportion of total unemployment accounted for by regular beneficiaries.

TABLE 2. Ratio of Regular Beneficiaries Without Earnings to Total Unemployment (LFS), Selected Economic Regions, Annual Averages, 1981-1984

	1981	1982	1983	1984
Economic Region(s)				
62	0.50	0.77	0.67	0.72
72	0.38	0.50	0.55	0.58
81	0.39	0.62	0.60	0.75
87-88	0.57	0.59	0.72	0.83
98-99	0.77	0.87	0.87	0.87
Yukon (1981 Census):	0.65			

A regression model based on the Northern Economic Regions 87-88 and 98-99 would be at best a poor compromise between two areas which until 1984 differed substantially with respect to the ratio of regular beneficiaries to total unemployment.

The initial emphasis on the similarity between the Yukon and the regions chosen to develop a model which could be applied to the Yukon was perhaps misplaced. The economic base of an area is dependent, among other things, on local resources, access to transportation, and historical factors. Geographic proximity alone is no guarantee of similarity. The Yukon itself possesses two characteristics which make it a somewhat unique area: 1) two thirds of the population is concentrated in a single centre (Whitehorse); 2) over 20% of the labour force is in public administration and defence (1981 Census). It became apparent that regular beneficiaries alone would not suffice to develop a model which could be applied to the Yukon with some chance of yielding a reasonable estimate. Some additional local data had to be introduced which reflected the economic structure of an area and which could explain, at least in part, the observed variability in the regular beneficiary-to-LFS unemployment ratio. For example, one might expect differences in the overall participation rate from area to area to be largely attributable to differences in the participation rate of women and that given the pattern of intermittent participation in the labour force on the part of many women, areas with a high participation rate would be characterized by a greater proportion of re-entrants. On the other hand, areas with high seasonal employment might be expected to contribute proportionally more job losers or leavers to the ranks of the unemployed at certain times of the year than areas with a more stable employment pattern. However, such statements, although plausible, do not translate easily into precisely defined relationships. Given the lack of any precise relationship between the level of unemployment and any additional labour market variables that might be included in a regression model, it was decided to make the choice of such variables an empirical one, falling on those variables that appeared to be the best

symptomatic indicators of variations in the level of unemployment from area to area. There is always a certain arbitrariness in specifying models in this fashion. The usual criticism levelled at this approach is that one is modelling the data rather than the underlying phenomena producing the data, and that it is never clear what assumptions one is making, as it is in the case of synthetic estimation. However, economic phenomena are in general so complex that it is often not possible to derive an acceptable model from economic theories of the labour market. The approach adopted in the Yukon model development work has been to aim for a model which performs well rather than one based on theoretically postulated relationships but which produces statistically mediocre results.

IV. Choosing among Alternative Models

The question of performance immediately raises the issue of evaluation: how is one to determine if a particular model produces "reasonable" estimates? The only recent and credible survey-based unemployment reading for the Yukon is from the 1981 Census, and clearly a point-in-time comparison of the unemployment level is a less than adequate measure of performance. The lack of any corroborating data for the Yukon, the heterogeneity in the regular beneficiary-to-unemployment ratios, and the "uniqueness" of the Yukon have left little choice but to aim for a "robust" model, that is, one which will work for a wide variety of areas outside the Yukon, using as a criterion of performance the concordance of the regression estimates with those produced by the Labour Force Survey itself. Since the Survey estimates are subject to sampling variability, they cannot be considered a "true" point of reference. However, they do serve as a guide, and at the very least, any model considered should produce estimates which deviate less from Survey estimates for areas and over time periods where the latter are known to be more reliable. If the model is robust, that is, if it produces reasonable estimates over many disparate areas, then it can be applied with some confidence to areas like the Yukon which have not contributed directly to the estimation of model parameters.

V. The Yukon Unemployment Model

The areas chosen for model development and evaluation were Labour Force Economic Regions west of Ontario.[3] It was felt that this would provide a sufficient array of areas of varying economic and labour force characteristics to act as a good test of robustness. The choice of Economic Regions was based on the desire to use subprovincial areas for which survey estimates were sufficiently reliable that the estimation of parameters and the evaluation of estimates would not be overly affected by the presence of noise. Monthly data from 1981 to 1984 were used to estimate model parameters. The dependent variable in the model was the log of the Labour Force Survey ratio of unemployment to sampled population. The modelling of unemployment levels was abandoned early on when it was realized that the estimated intercept term for a level model would itself be a level and would thus contribute a base unemployment level for each area that would be independent of area size. The choice of independent variables had to be limited to data that was available for both Economic Regions and the Yukon. In the absence of timely economic or labour force symptomatic variables at the small area level, it was decided to test the "explanatory" power of Census data. Although these are point-in-time figures, it was expected that any large differences between areas in the participation rate, in the distribution of the total labour force by industry and by size of area would be more or less preserved over time. The variables retained were as follows:

- log of the ratio of regular beneficiaries without earnings to sampled population;
- participation rate (1981 Census);
- percent of the labour force in forestry (1981 Census);
- percent of the labour force in fishing and trapping (1981 Census);
- percent of the labour force in manufacturing (1981 Census);
- percent of the labour force in construction (1981 Census);
- percent of the labour force in trade (1981 Census);
- percent of the labour force in community, business, and personal services (1981 Census);

[3] Economic Region 76, which falls entirely in the Labour Force Survey's remote area frame, was a consistent outlier for the models tested and was excluded from the final model adopted.

- percent of the labour force in public administration and defence (1981 Census);
- percent of the labour force living in urban areas of population greater than 30,000 (1981 Census);
- monthly dummy variables (12: model intercept suppressed);
- annual dummy variables (3: 1982-1984, 1981 was the excluded year).

The choice of variables was made on the basis of a stepwise regression, using the maximum R^2 improvement technique. A model was selected on the basis of a cutoff criterion proposed by Mallows.[4] The monthly dummy variables were included because the "new entrant/re-entrant" component of unemployment is known to exhibit some seasonal behaviour.[5] Finally the annual dummy variables were incorporated into the model to account for any changes over time in the regular beneficiary-to-unemployment ratio. Once the predicted ratios of unemployment to sampled population were obtained from the regression, the unemployment estimates for each Economic Region were generated using the survey's monthly estimate of the sampled population. The parameter estimates for the fitted model are found in the appendix with accompanying documentation from the software package used for estimation.

VI. Evaluation Results

The monthly estimates generated from the regression were compared to the survey estimates and the average absolute relative difference calculated for each Economic Region. That is, if ${}_sU_t$ and ${}_rU_t$ represent the survey and regression estimates respectively for month t, then the average absolute relative difference (ARD) is calculated as:

$$\sum_{t=1}^{N} \left| \frac{{}_sU_t - {}_rU_t}{N \cdot {}_rU_t} \right| \times 100,$$ where N is the number of months for which estimates have been generated.

In order to produce the following table, the monthly estimates from the regression and the survey estimates, were averaged over various estimation periods (i.e., quarterly, semi-annually, etc.) and average absolute relative differences calculated for each estimation period. The Economic Regions are sorted in order of increasing average ARD of the monthly estimates.

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4 Mallows, C.L. (1984), "Some Comments on C_p", Technometrics, 15, 661-675.

5 See "Flows into Unemployment: Entrants and Re-entrants", The Labour Force (Statistics Canada, Cat. No. 71-001), June 1985.

TABLE 3. Average Absolute Relative Differences, Labour Force Survey Estimates and Model Estimates of Unemployment, Economic Regions, Prairies and British Columbia, 1981-1984

Economic Region	Average Absolute Relative Differences (Percents)					
	Monthly	Quarterly	Semi-annual	Annual	2-year	4-year
86 (Edmonton)	6.9	5.6	4.8	4.4	1.7	0.4
83 (Calgary)	7.7	6.8	4.9	3.0	1.7	0.2
67 (Winnipeg)	8.5	7.7	6.5	6.4	4.9	5.4
96 (Victoria)	8.7	7.9	7.6	5.5	3.8	3.4
95 (Vancouver)	8.8	7.4	6.7	6.5	4.5	0.9
73 (Saskatoon)	10.2	7.7	7.4	7.6	6.7	6.4
75	12.4	11.0	9.4	9.4	8.6	2.3
93	12.7	10.5	8.6	6.0	6.1	4.5
92	12.8	11.2	9.7	6.2	4.2	0.2
71 (Regina)	14.1	12.1	7.9	6.9	1.9	2.2
87-88	14.6	12.1	9.5	9.7	3.8	4.6
63	14.9	12.3	11.3	6.1	6.0	5.9
98-99	15.5	11.3	10.4	3.9	1.4	1.6
94	15.6	13.4	13.2	13.2	13.3	13.0
65	16.0	12.5	9.9	10.1	0.8	0.0
97	16.3	14.8	14.5	14.5	7.0	7.6
61	17.4	15.9	14.5	14.3	12.0	12.6
74	17.5	14.9	13.8	9.6	10.5	8.1
82	17.6	16.1	10.1	6.7	3.8	0.1
64	18.2	11.5	9.6	9.6	10.0	9.5
85	19.4	16.8	15.2	15.2	12.7	8.4
72	20.6	15.2	11.7	10.4	9.8	8.5
62	21.1	17.8	16.7	10.9	7.3	6.9
84	21.2	14.9	12.4	8.0	2.4	1.9
81	21.3	17.5	12.7	8.9	2.6	1.9
91	21.7	17.8	11.9	9.4	9.4	10.7
66	23.7	21.2	19.8	19.6	16.5	15.1
68	33.6	30.5	23.3	24.0	14.3	13.5
All regions	16.0	13.4	11.2	9.5	6.7	5.6

Several tendencies are evident:

1) For monthly, quarterly, and semi-annual estimates, the model agrees best with survey estimates in Economic Regions where the latter are most reliable. Since each Economic Region was given essentially equal weight in the regression, this result suggests that the differences in the average absolute relative differences from region to region for monthly, quarterly, and semi-annual estimates may be attributable to differences in the sampling variability of the survey estimates.

2) Generally, as the estimation period lengthens, the average absolute relative differences decrease. Since the survey estimates become more reliable as one averages over longer and longer periods, this again would appear to suggest that the average absolute relative differences may be correlated with the sampling variability of the survey estimates. As the absolute relative differences decrease, the model error comes into play, so that the tendency to decrease might be expected to level off after a point, which is indeed the case for many Economic Regions. Alternatively, the process of averaging would tend to smooth out seasonal effects, which the model may be capturing only imperfectly. The decrease in the average absolute relative differences would then be symptomatic of this smoothing effect, which would be expected to level off beyond annual estimates.

Graphs of the model and unemployment estimates for a sample of Economic Regions appear in the Appendix. The charts generally favour the first hypothesis. Economic Region survey estimates are sometimes subject to sudden changes in levels from month to month, which can likely be attributed to changes in the composition of the sample and which would tend to average out over time. The large samples in Economic Regions containing CMA's would ensure a certain smoothness in the estimates.

In addition to the absolute relative differences considered above, average relative differences were computed as well. They are defined as: $\sum_{t=1}^{N} \frac{{}_sU_t - {}_rU_t}{N \cdot {}_rU_t} \times 100$, where ${}_sU_t$, ${}_rU_t$, and N are as before.

TABLE 4. Average Relative Differences, Labour Force Survey Estimates and Model Estimates of Unemployment, Economic Regions, Prairies and British Columbia, 1981-1984

Economic Region	Average Relative Differences (Percents)					
	Monthly	Quarterly	Semi-annual	Annual	2-year	4-year
86 (Edmonton)	0.3	0.3	0.3	0.3	- 0.2	0.4
83 (Calgary)	- 0.8	- 0.9	- 0.7	- 0.7	- 0.7	- 0.2
67 (Winnipeg)	- 4.4	- 4.4	- 4.5	- 4.4	- 4.9	- 5.4
96 (Victoria)	- 3.3	- 3.3	- 3.2	- 3.4	- 3.8	- 3.4
95 (Vancouver)	- 2.4	- 2.5	- 2.6	- 2.4	- 1.9	- 0.9
73 (Saskatoon)	7.6	7.5	7.4	7.6	6.7	6.4
75	0.5	0.5	0.5	0.6	0.9	2.3
93	3.4	3.4	3.4	3.6	3.5	4.5
92	0.3	0.3	- 0.0	0.1	- 0.4	0.2
71 (Regina)	0.2	- 0.3	- 0.4	- 0.5	- 1.9	- 2.2
87-88	- 5.9	- 5.9	- 5.7	- 5.5	- 3.8	- 4.6
63	- 5.2	- 5.3	- 5.0	- 5.3	- 6.0	- 5.9
98-99	- 2.5	- 2.4	- 2.3	- 2.1	- 1.4	- 1.6
94	13.3	13.0	13.2	13.2	13.3	13.0
65	0.1	0.4	0.2	0.4	0.1	- 0.0
97	5.1	5.2	5.3	5.4	7.6	7.6
61	- 13.3	- 13.2	- 13.3	- 13.1	- 12.0	- 12.6
74	- 8.0	- 7.9	- 7.9	- 8.8	- 9.7	- 8.1
82	1.4	1.2	1.4	1.4	0.9	- 0.1
64	9.1	9.1	9.6	9.6	10.0	9.5
85	10.8	11.0	11.2	11.3	12.1	8.5
72	11.2	10.8	10.7	10.4	9.8	8.5
62	9.2	9.0	8.8	8.8	7.3	6.9
84	- 1.9	- 1.6	- 1.6	- 0.9	- 2.4	- 1.9
81	2.3	2.5	3.1	3.4	2.5	1.9
91	9.3	9.2	9.2	9.4	9.4	10.7
66	18.1	17.7	17.8	17.7	16.5	15.1
68	8.7	9.1	9.2	10.1	14.3	13.5
All regions	2.3	2.2	2.3	2.4	2.4	2.2

Ideally, if the model estimator were unbiased[6], the relative differences of the monthly estimates, when averaged over all Economic Regions and all months, would be close to zero. However, it can be seen that the model tends to underestimate on average by about two to two and one-half percent.

The results for individual Economic Regions vary widely, with five Economic Regions (61, 66, 68, 91, 94) having rather large (> 10%) relative differences for four-year averages. The average relative differences, moreover, tend to be independent of the estimation period, which suggests that the model on average consistently over- or under-estimates the level of unemployment in a given Economic Region. Hence no reduction in bias can be gained by averaging over longer periods of time. The average relative differences can probably be taken as a fairly good measure of model bias. Their invariance with respect to the estimation period lends further credence to the contention made earlier that the average absolute relative differences incorporate a certain amount of sampling variability.

Biases of the order observed would generally be considered unacceptable for sample-based estimates. However, there is a certain trade-off to be made because the model-based estimates considered here are not subject to sampling variability. The coefficients of variation of Labour Force Survey monthly estimates of unemployment for Western Economic Regions range from 5% to as high as 25%. Under certain conditions, an estimate with a probable bias of 5-10% and no sampling variability may be preferable to an unbiased estimate with a coefficient of variation of 25%. For example, a coefficient of variation of 25% on an estimated

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6 Strictly speaking, a regression model produces unbiased estimates if certain standard assumptions are satisfied and if the postulated model is true. In practice, a given model will be only "approximately true", so that a certain amount of bias can be expected. In addition, the use of the terms "model bias" in the text is somewhat non-standard, because estimates of unemployment levels are obtained only after applying an appropriate functional transformation to the actual regression estimates.

unemployment rate of 10% yields a 95% confidence interval of 5 to 15%. In the face of such a wide interval, a bias of 10% for an estimate not subject to sampling variability seems almost derisory. On the other hand, the biases of the regression-based estimates considered in this report are not reduced by averaging over longer periods of time, whereas sample-based estimates can gain considerably in precision through averaging.

One might expect comparisons with census data to be somewhat revealing. However, 1981 Census unemployment levels do not agree very well with Labour Force Survey estimates, even when the Census is redefined to the Survey universe. For the sake of completeness, the comparison is nonetheless included in this report. Because the Labour Force Survey and the Census have different reference periods, the Survey estimates for May and June 1981 have been averaged in the following table.

TABLE 4. Unemployment Levels and Differences Relative to Census, Labour Force Survey and Model Estimates, Economic Regions, Prairie Region and British Columbia

	Unemployment Levels			Differences Relative to Census (%)	
	Census	LFS	Model	LFS	Model
Economic Region					
61	1,140	858	1,318	- 24.8	15.6
62	730	705	670	- 3.4	- 8.3
63	2,100	1,536	1,798	- 26.9	- 14.4
64	955	893	739	- 6.5	- 22.6
65	1,127	1,013	902	- 10.2	- 19.9
66	1,465	1,844	1,308	25.5	- 10.7
67 (Winnipeg)	15,560	17,200	16,290	10.5	4.7
68	1,518	938	1,076	- 38.2	- 29.1
MANITOBA	24,595	24,987	24,101	1.6	- 2.0
71 (Regina)	5,121	3,816	4,070	- 25.4	- 20.5
72	1,955	2,175	1,656	11.2	- 15.3
73 (Saskatoon)	6,030	6,796	4,949	12.7	- 17.9
74	1,940	768	1,408	- 60.4	- 27.4
75	4,142	3,482	3,635	- 15.9	- 12.2
76	(677)	(139)	-	(- 79.5)	-
SASKATCHEWAN	19,188	17,037	15,718	- 13.5	- 18.1
81	1,400	996	1,070	- 28.9	- 23.6
82	2,525	1,484	1,995	- 41.2	- 20.9
83 (Calgary)	12,800	11,616	13,869	-9.3	8.3
84	1,430	1,145	1,124	- 19.9	- 21.4
85	3,195	2,533	2,268	- 20.7	- 29.0
86 (Edmonton)	16,945	16,201	15,740	- 4.4	- 7.1
87-88	5,420	3,275	4,498	- 39.6	- 17.0
ALBERTA	43,715	37,250	40,564	- 14.8	- 4.3
91	1,665	1,982	1,655	19.0	- 0.6
92	3,950	3,523	3,567	- 10.8	- 9.7
93	8,283	5,559	7,265	- 32.9	- 12.3
94	4,233	5,189	4,368	22.6	3.2
95 (Vancouver)	39,771	37,812	37,786	- 4.9	- 5.0
96 (Victoria)	17,075	19,842	17,929	15.9	5.0
97	7,930	5,097	7,819	- 35.7	- 1.4
98-99	4,635	2,880	3,957	- 37.8	- 14.6
BRITISH COLUMBIA	87,542	81,884	84,346	- 6.5	- 3.7

Generally the agreement between the model estimates and the Census is roughly comparable to that between the Survey estimates and the Census. Both tend to be low relative to the Census. Overall, however, the comparison is somewhat less than illuminating.

VII. Yukon Unemployment Estimates

In applying the coefficients estimated from the regression to data from the Yukon, there is of course no guarantee that the resulting estimates will be free of serious error. Indeed, for 5 of the 28 Economic Regions used in the estimation of model parameters, the bias of the model unemployment estimates was relatively large (i.e.>10%). A look at Census data for the poorer model performers did not reveal any obvious factors by which they could be characterized. On the other hand, given the variety of regions considered, the model performed fairly well in most other areas, with 19 of the 28 Economic Regions having absolute model biases (i.e., 4-year absolute relative differences) of under 8%. The Census/model results for the Yukon are 1005/882, a relative difference of -12.3%. However, as was seen above, the Census unemployment level for Western Economic Regions was generally higher than the Labour Force Survey level (by an average 15.8%), so that the Census/model difference is hardly exceptional.

The monthly unemployment estimates predicted by the model for the Yukon for 1981-1984 are given in the following table, along with the beneficiary counts.[7] A graph of the estimates is included in the appendix.

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[7] The generation of these estimates required monthly sampled population figures for the Yukon. The problem with the population projections for the Yukon alluded to earlier lay not with the projection for the total population aged fifteen and over but with its distribution by age and sex. The population figures used to generate the unemployment estimates for the Yukon are taken from the Yukon Health Care System (YHCS), decremented by the proportion of inmates and full-time armed forces personnel in the Yukon at the time of the Census. Comparison of the official June 1st Demography Division population estimates for 1981-1983 with the YHCS figures show differences of less than three percent.

TABLE 5. Regular Beneficiaries without Earnings and Model Estimates of Unemployment, Yukon, 1981-1984

	1981		1982		1983		1984	
	RBNE	Unemployed	RBNE	Unemployed	RBNE	Unemployed	RBNE	Unemployed
Jan.	904	1,084	1,159	1,367	2,062	1,927	1,718	1,701
Feb.	967	1,088	1,243	1,388	2,128	1,897	1,733	1,663
Mar.	989	1,194	1,272	1,485	2,125	2,047	1,847	1,862
Apr.	932	1,112	1,302	1,393	2,072	1,926	1,814	1,773
May	758	979	1,208	1,330	1,738	1,687	1,441	1,550
June	543	784	968	1,164	1,323	1,424	1,109	1,318
July	482	821	1,049	1,326	1,121	1,447	1,023	1,407
Aug.	472	795	1,166	1,364	974	1,310	962	1,334
Sept.	393	779	1,170	1,452	812	1,281	942	1,413
Oct.	470	833	1,374	1,544	929	1,341	1,211	1,572
Nov.	661	1,022	1,643	1,729	1,184	1,547	1,529	1,819
Dec.	917	1,125	1,871	1,718	1,413	1,585	1,733	1,811
Annual Average	707	968	1,285	1,438	1,490	1,618	1,422	1,602

Until late in 1982, the model estimates and the regular beneficiary counts move in parallel. With the large increases in the number of regular beneficiaries in the last three months of 1982, the beneficiary counts overtake the unemployment estimates in December and remain higher than the latter during the winter months before returning to the usual pattern the following June. A similar phenomenon is apparent for 1983-1984. The fact that the regular beneficiary counts exceed the unemployment estimates, given the conceptual correspondence between regular beneficiaries and a subset of the unemployed, should not in itself be cause for alarm. This apparent anomaly is almost the rule in the Maritime provinces, in parts of Quebec, and in certain Northern and largely remote Economic Regions (68 and 76, for example). One is perhaps more reluctant to consider such a conceptual anomaly as real when the estimate of unemployment is model-based rather than sample-based, since there is always the possibility that the model may not carry over well to the Yukon. It may be that the Census industry

variables in the model do not adequately distinguish between the Yukon and other areas with respect to the beneficiary-to-unemployment ratio. However, a regression run with the full complement (11) of Census industry variables yielded essentially the same results. Alternatively, it might be argued that the post-recession labour market is very different from what it was prior to 1982, and that the model is capturing only imperfectly changes in the beneficiary-unemployment relationship. On the other hand, a regression run using only 1983 and 1984 data yielded unemployment estimates for the Yukon for those years that behaved similarly to those produced from the model developed using 1981-1984 data.

VIII. Conclusion

It would be premature to claim that the model presented above represents the last word with respect to a model-based estimate of unemployment for the Yukon. The model, for example, does not consider the possibility that different Census variables may be better symptomatic indicators of the beneficiary-to-unemployment ratio at different times of the year. The use of current survey-based employment data as an independent variable (despite the sampling variability of such data) was explored at an early stage of model development. Although the results did not appear promising, it is possible that further analysis could modify that conclusion. Finally, as the model-based work of the Small Area Data Program progresses, new methods and data sources may well be developed which could contribute to the modification and/or enrichment of the model presented in this report.

APPENDIX

DEP VARIABLE: UNEMPL

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PROB>F
MODEL	25	12137.343	485.494	10551.819	0.0001
ERROR	1319	60.687754	0.046010		
U TOTAL	1344	12198.031			

ROOT MSE	0.214500	R-SQUARE	0.9950
DEP MEAN	-2.972714	ADJ R-SQ	0.9949
C.V.	-7.21564		

NOTE: NO INTERCEPT TERM IS USED. R-SQUARE IS REDEFINED.

VARIABLE	DF	PARAMETER ESTIMATE	STANDARD ERROR	T FOR H0: PARAMETER=0	PROB > |T|
RENE	1	0.505720	0.021116	23.950	0.0001
M1	1	-2.502365	0.211860	-11.811	0.0001
M2	1	-2.532804	0.211216	-11.992	0.0001
M3	1	-2.456253	0.211240	-11.628	0.0001
M4	1	-2.495895	0.211692	-11.809	0.0001
M5	1	-2.521017	0.213811	-11.791	0.0001
M6	1	-2.554669	0.215462	-11.857	0.0001
M7	1	-2.451820	0.215383	-11.384	0.0001
M8	1	-2.477601	0.215041	-11.522	0.0001
M9	1	-2.413407	0.217131	-11.115	0.0001
M10	1	-2.437252	0.216367	-11.264	0.0001
M11	1	-2.412957	0.214143	-11.268	0.0001
M12	1	-2.483827	0.211799	-11.727	0.0001
Y82	1	0.096055	0.022619	4.247	0.0001
Y83	1	0.173390	0.025188	6.884	0.0001
Y84	1	0.160017	0.025375	6.306	0.0001
PARTRATE	1	0.715673	0.163878	4.367	0.0001
FORESTRY	1	4.455008	0.505525	8.813	0.0001
FISHTRAP	1	-10.956413	1.907366	-5.744	0.0001
MFG	1	0.608929	0.193333	3.150	0.0017
CONSTR	1	2.034693	0.382241	5.323	0.0001
TRADE	1	-1.553931	0.688174	-2.258	0.0241
SERVICES	1	1.921301	0.286896	6.697	0.0001
PUBADMIN	1	1.247952	0.385465	3.238	0.0012
CITIES	1	0.217372	0.041725	5.210	0.0001

CHART 1: Regular UI Beneficiaries Without Earnings and Job Losers / Job Leavers
April 1978 to June 1984

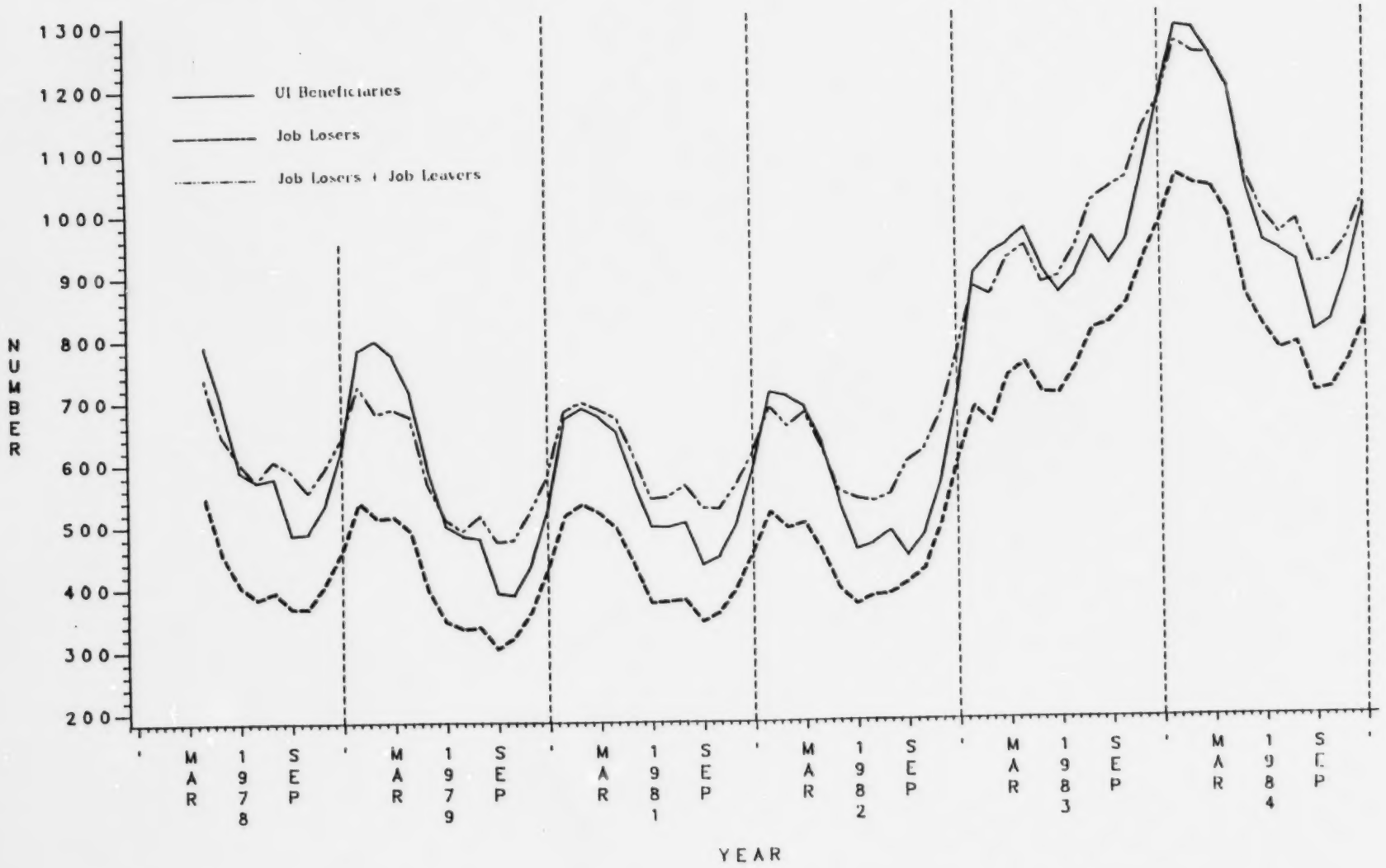

CHART 2: Regular UI Beneficiaries, Labour Force Survey Unemployed, Model Estimates, 1981–1984
ER=62

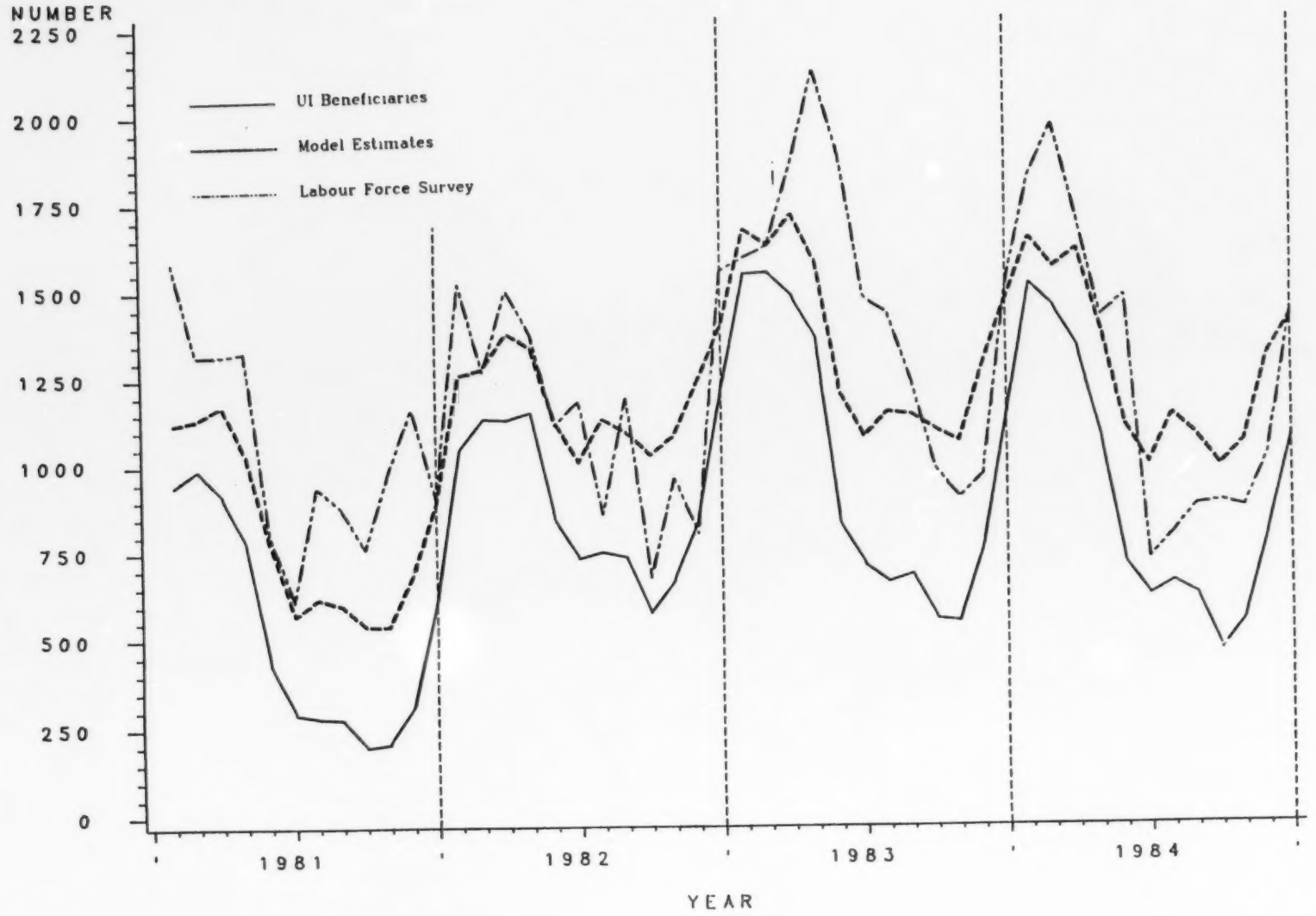

CHART 2: Regular UI Beneficiaries, Labour Force Survey Unemployed, Model Estimates, 1981–1984
ER=67

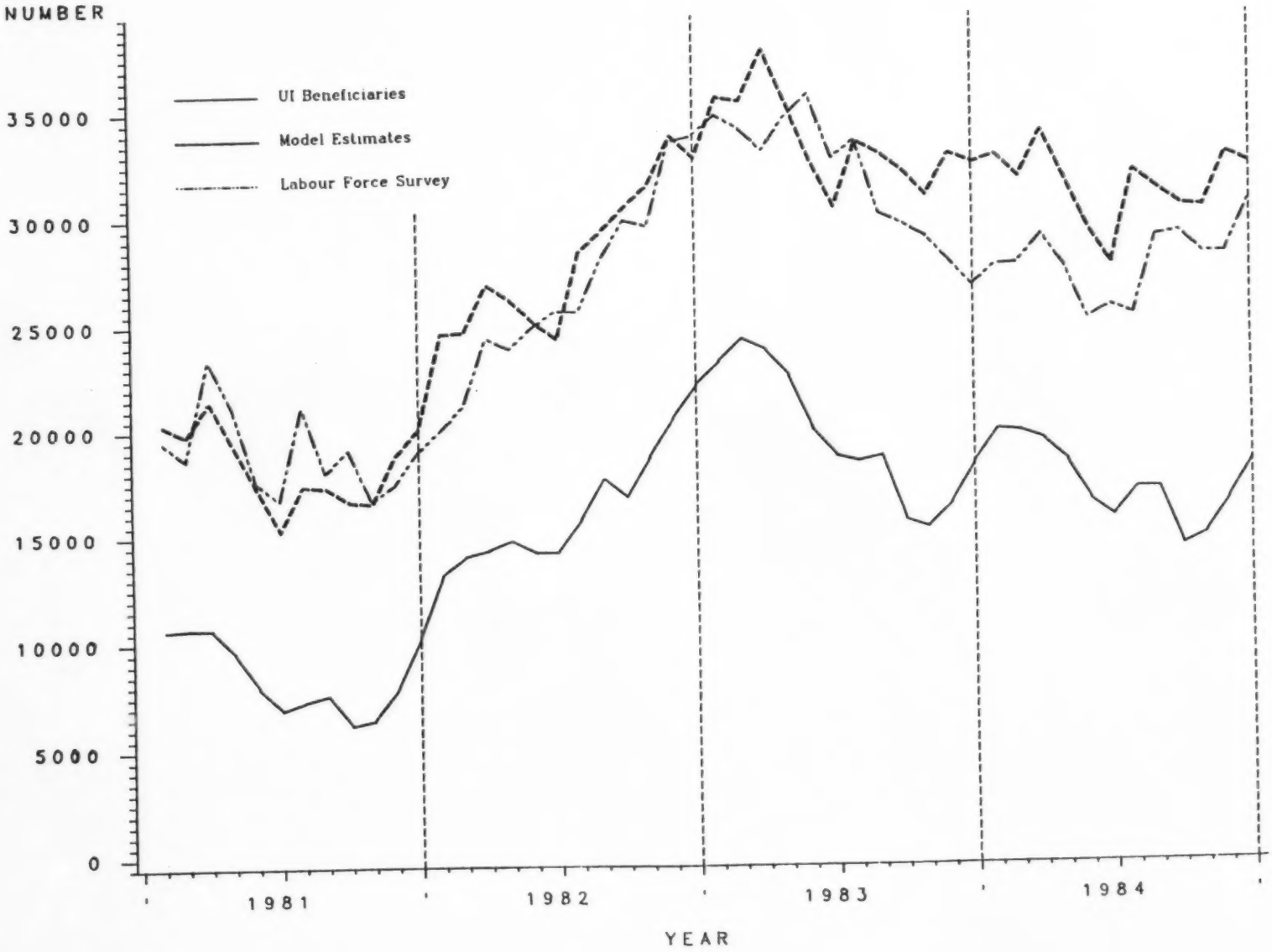

CHART 2: Regular UI Beneficiaries, Labour Force Survey Unemployed, Model Estimates, 1981–1984

ER=68

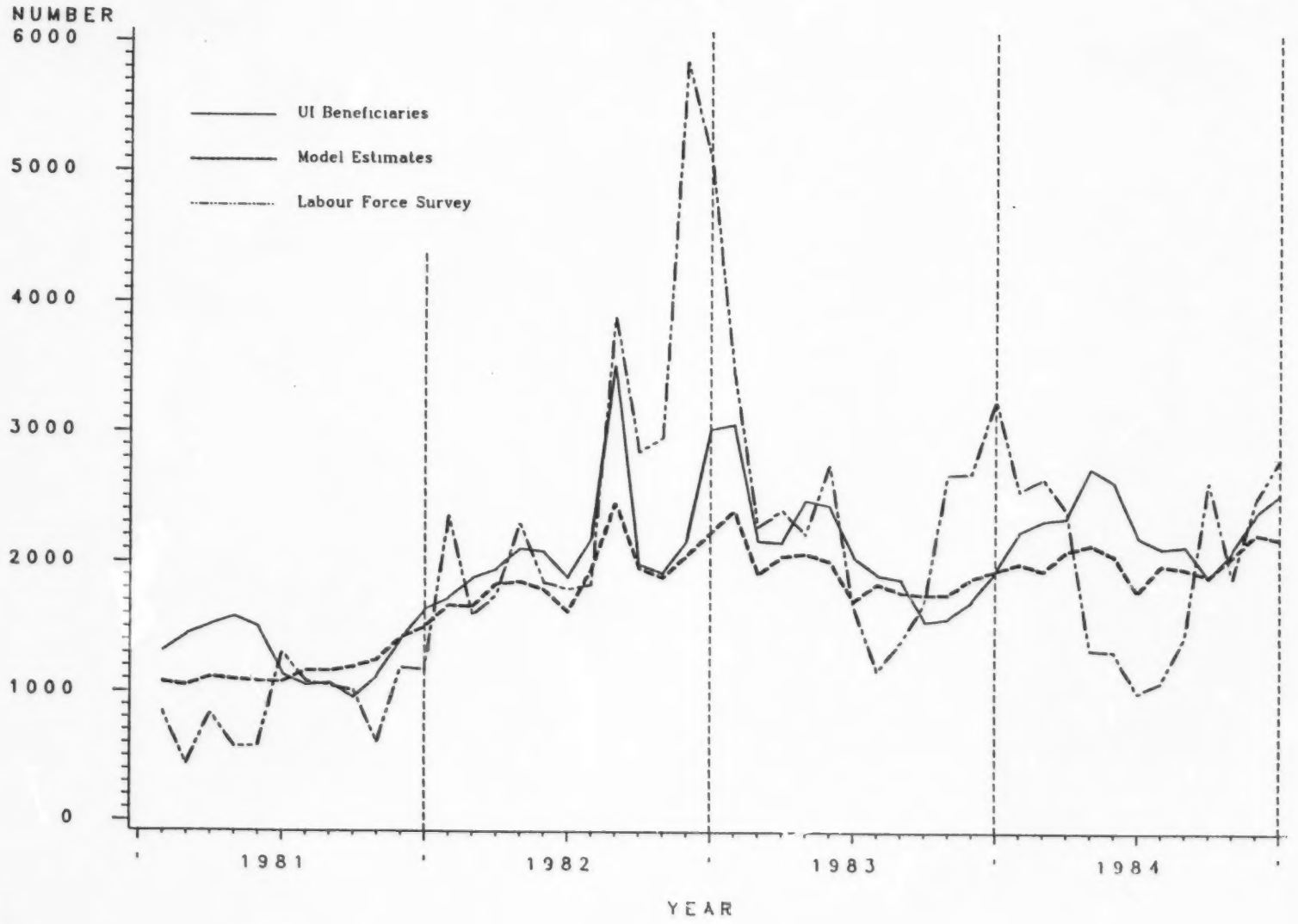

CHART 2: Regular UI Beneficiaries, Labour Force Survey Unemployed, Model Estimates, 1981–1984

ER=74

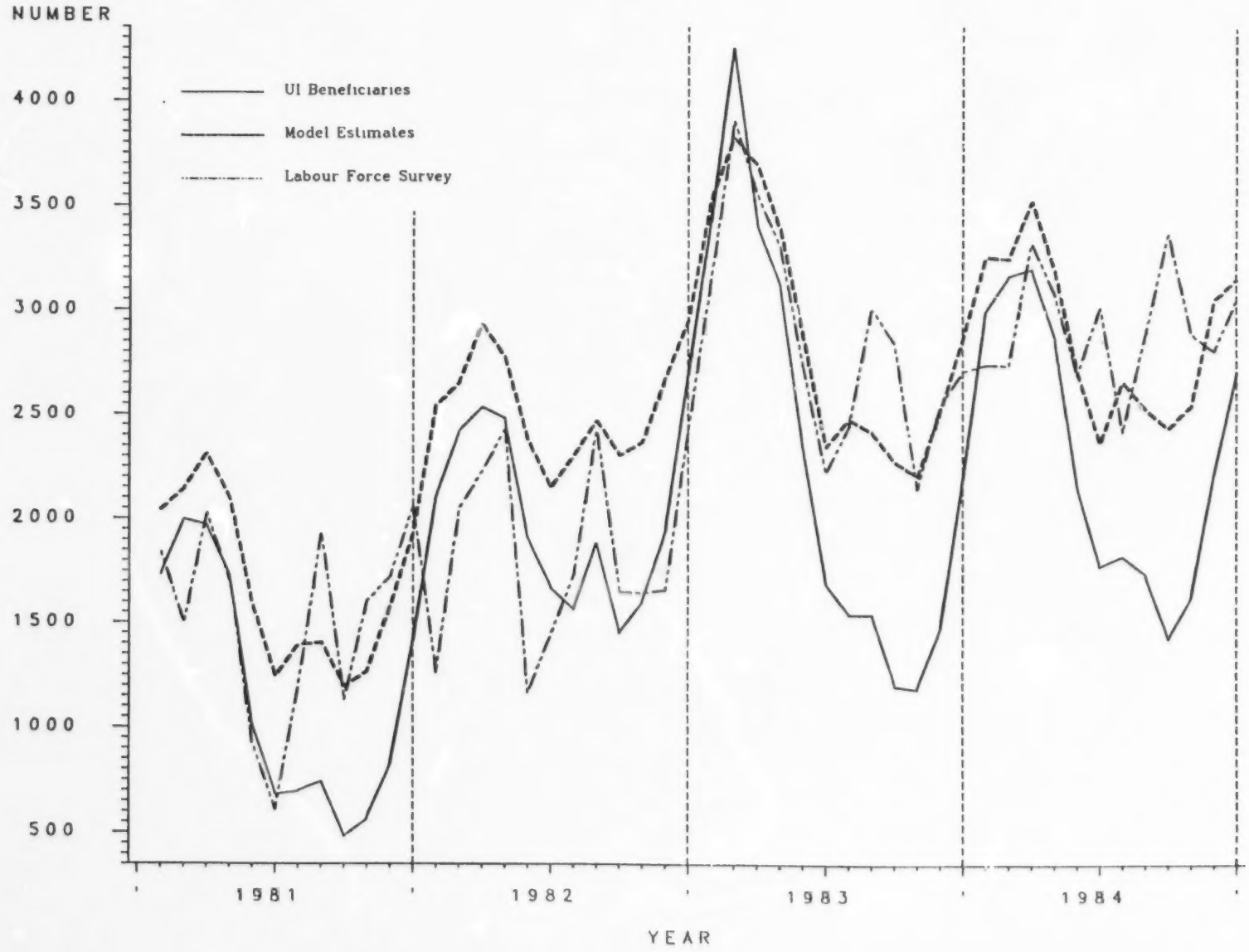

CHART 2: Regular UI Beneficiaries, Labour Force Survey Unemployed, Model Estimates, 1981–1984

ER=93

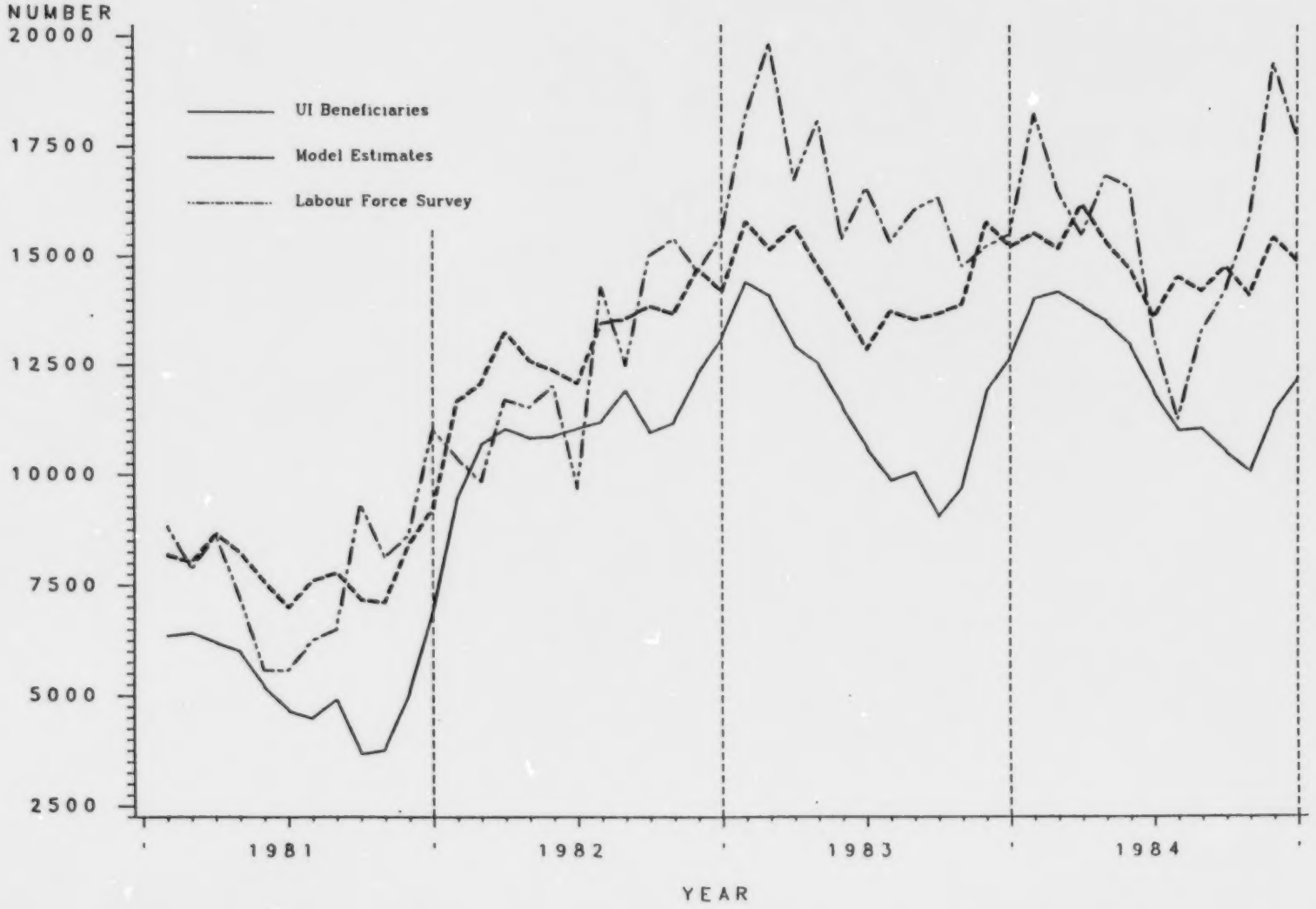

CHART 2: Regular UI Beneficiaries, Labour Force Survey Unemployed, Model Estimates, 1981–1984

ER=98

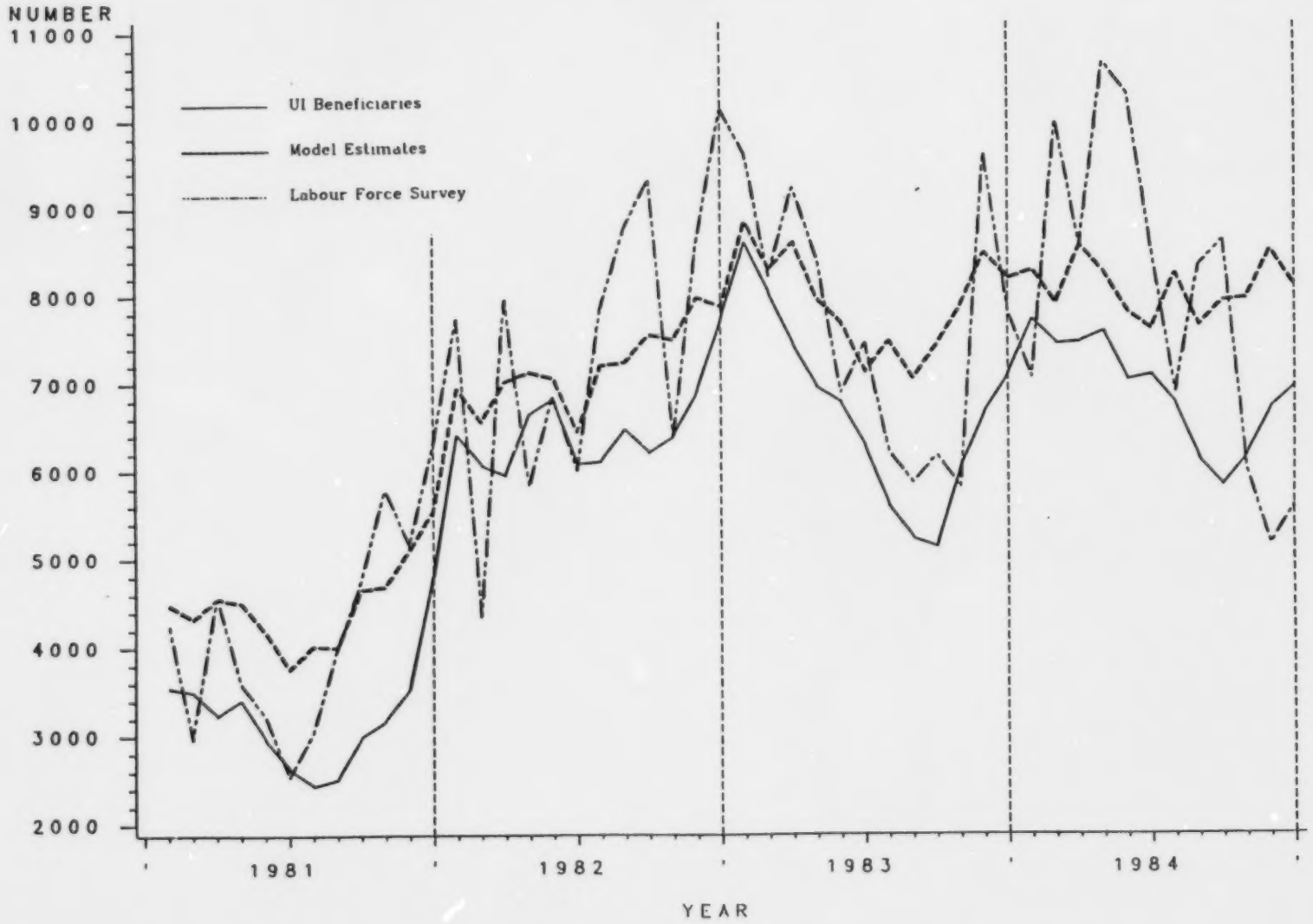

CHART 8: Regular Beneficiaries and Model-Based Estimates of Unemployment, Territory of the Yukon, 1981 - 19